National Institute of Environmental Health Sciences

Development of spatial water resources vulnerability index considering climate change impacts

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Abstract:

This study developed a new framework to quantify spatial vulnerability for sustainable water resources management. Four hydrologic vulnerability indices--potential flood damage (PFDC), potential drought damage (PDDC), potential water quality deterioration (PWQDC), and watershed evaluation index (WEIC)--were modified to quantify flood damage, drought damage, water quality deterioration, and overall watershed risk considering the impact of climate change, respectively. The concept of sustainability in the Driver-Pressure-State-Impact-Response (DPSIR) framework was applied in selecting all appropriate indicators (criteria) of climate change impacts. In the examination of climate change, future meteorological data was obtained using CGCM3 (Canadian Global Coupled Model) and SDSM (Statistical Downscaling Model), and future stream run-off and water quality were simulated using HSPF (Hydrological Simulation Program - Fortran). The four modified indices were then calculated using TOPSIS, a multi-attribute method of decision analysis. As a result, the ranking obtained can be changed in consideration of climate change impacts. This study represents a new attempt to quantify hydrologic vulnerability in a manner that takes into account both climate change impacts and the concept of sustainability.

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Resource Description

Climate Scenario : ☑

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1, SRES A2

Other Climate Scenario: A1B

Communication: ☑

resource focus on research or methods on how to communicate or frame issues on climate change; surveys of attitudes, knowledge, beliefs about climate change

A focus of content

Communication Audience: ☑

audience to whom the resource is directed

Researcher

Other Communication Audience: Water security managers

Exposure :

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality

Extreme Weather Event: Drought, Flooding

Geographic Feature:

resource focuses on specific type of geography

Freshwater

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: South Korea

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

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